

## G-2. level 1 processors

### 1.0 General Information

The purpose of the level 1 data processing programs is to read data from the 'raw' database tables (*pecrsep* and *pedrsep*), perform some basic quality control and data transformation, encode the data into SHEF messages, and then pass the message(s) to the *shef\_decode\_pro* application for posting to the 'processed' database tables (*pehpsep*, *peqpsep*, and *pedpsep*). Each individual program is described in greater detail below. These programs are written in *ecpg/C*. Flow charts for the individual programs are included in Attachment A.

#### 1.1 Enhancements/Bug Fixes/Changes

##### **Build OB7.2**

The applications were converted to *ecpg/C* from *esql/C* (Informix) to work with the Postgres RDBMS. Documentation was updated to reflect this change.

##### **Build OB6**

###### ***Bug Fixes***

For all level 1 processors

- R1-36 Code changed so that a "/" at the end of the pathname defined by the apps defaults token *adb\_pro\_que* is not required.

For *process\_stage*

- R1-40 Application modified so that negative stages can be handled.

##### **Build OB5**

###### ***Enhancements***

- Modified *process\_stage* application to take into account Build OB5 changes to table *rivercrit*.
- Script, *run\_level1\_process*, used by oper's cron, was changed to use baseline *amirunning* script to check to see if cron is still running this script from a previous execution time.

##### **Build OB4**

###### ***Enhancements***

- *Process\_stage* was changed to allow height data to be SHEF encoded.

### **Bug Fixes**

For all level 1 processors

- all level 1 processors now use the *sensok* table properly
- how all the level 1 processors handle the data qualifier code "M" in the processed DB tables has been fixed
- the limitation on not allowing data older than 1990 has been removed
- the level 1 processors can now process up to one years' worth of data at a time

For *process\_precip*

- The problem *process\_precip* was having transforming the SHEF PE "PC" properly has been fixed

## **1.2 Application Description**

### ***process\_precip***

This program reads 'raw' accumulated precipitation (SHEF PEDTSEP = 'PCIR\*ZZ') from the *pecrsep* table and creates level 1 incremental precipitation to be stored in the 'processed' tables as follows:

- PPH – hourly increments (0z-1z, 1z-2z, etc.) -> *pehpsep* table
- PPQ – six hourly increments (0z-6z, 6z-12z, etc.) -> *peqpsep* table
- PPD – daily increments (12z-12z) -> *pedpsep* table

Quality control routines look at the entire time series and attempt to smooth out up/down fluctuations and try to recognize when a gage has been reset. There are very gross maximum allowed values defined within the program: MAXPPH=5, MAXPPQ=10, MAXPPD=20. It also looks in the *sensok* table for any pertinent entries.

### ***transfer\_precip***

This program reads 'raw' incremental precipitation (SHEF PEDTSEP = 'PPHR\*ZZ', 'PPQR\*ZZ', 'PPDR\*ZZ') from the *pecrsep* and *pedrsep* tables and creates level 1 incremental precipitation to be stored in the 'processed' tables as follows:

- PPH – from *pecrsep* -> *pehpsep* table
- PPQ – from *pecrsep* -> *peqpsep* table
- PPD – from *pedrsep* -> *pedpsep* table

\*\*NOTE: PPH & PPQ transfer one less day of data than PPD because the first day of data is used as a buffer for finding the 0z value.

Quality control routines read in the value of the *quality\_code* column from the *pedrsep* table. There are very gross maximum allowed values defined within the program: MAXPPH=5, MAXPPQ=10, MAXPPD=20. It also looks in the *sensok* table for any pertinent entries.

### ***process\_stage***

This program reads 'raw' instantaneous height (i.e. stage, pool) and flow (SHEF PEDTSEP = 'H\*IR\*ZZ', 'Q\*IR\*ZZ') from the *pecrsep* table and creates level 1 hourly instantaneous height, flow, and storage to be stored in the *pehpsep* table as follows:

- H\* -> all transferred to level 1 H\*

- If \*=G and rating exists -> also process to level 1 QR
- If \*=P and rating exists -> also process to level 1 LS
- Q\* -> all transferred to level 1 Q\*

Quality control routines use information from the *rivercrit* table to determine the maximum and minimum flow/height values, as well as the maximum rate of change in flow/height, for each site. Sites for which flow is computed from height have each time series quality controlled separately with the *rivercrit* values so it is possible that their quality flags may not match. It also looks in the *sensok* table for any pertinent entries for the 'raw' SHEF PEDTSEP and applies the same quality flags for all processed time series.

### ***process\_temp***

This program reads 'raw' instantaneous temperature (SHEF PEDTSEP = 'TAIR\*ZZ') from the *pecrsep* table and creates level 1 hourly instantaneous temperature to be stored in the *pehpsep* table. It also creates level 1 maximum and minimum temperature to be stored in the *pedpsep* table. (NOTE: max/min values determined through this program will not overwrite max/min values from the *transfer\_txn* program (see below)).

Quality control routines look at the entire time series and attempt to eliminate unreasonable jumps between readings. There are very gross maximum and minimum allowed values defined within the program: MAX=130, MIN=-50. It also looks in the *sensok* table for any pertinent entries.

### ***transfer\_txn***

This program reads 'raw' daily maximum and minimum temperature (SHEF PEDTSEP = 'TAIR\*XZ', 'TAIR\*NZ') from the *pedrsep* table and creates level 1 daily maximum and minimum temperature to be stored in the *pedpsep* table. (NOTE: max/min values from this program take precedence over those determined through *process\_temp* by using a SHEF data qualifier code of 'V').

Quality control routines read in the value of the "quality\_code" column from the *pedrsep* table. There are very gross maximum and minimum allowed values defined within the program: MAX=130, MIN=-50. It also looks in the *sensok* table for any pertinent entries.

### ***process\_sw***

This program reads 'raw' instantaneous snow water equivalent (SHEF PEDTSEP = 'SWIR\*ZZ') from the *pecrsep* table and creates level 1 daily 12z instantaneous snow water equivalent to be stored in the *pedpsep* table.

Quality control routines look at the entire time series and attempt to eliminate unreasonable jumps between readings. There are very gross maximum and minimum allowed values defined within the program: MAX=500, MIN=0. It also looks in the *sensok* table for any pertinent entries.

### ***process\_flow***

This program reads 'raw' daily flow (SHEF PEDTSEP = 'Q\*DR\*ZZ') from the *pedrsep* table and creates level 1 daily flow to be stored in the *pedpsep* table.

Quality control routines read in the value of the "quality\_code" column from the *pedrsep* table. The program screens out negative values. It also looks in the *sensok* table for any pertinent entries.

## **1.3 Design Considerations**

The SHEF data qualifier codes that are used by the programs are based on SHEF Version 2.0.

Any data that is read in from the *pecrsep* and *pedrsep* tables with a SHEF qualifier code that indicates a 'good' value (G, M, S, V, P) will not be set bad in these programs as it is assumed to have been through some other quality control. Data that is read in with a qualifier code that indicates a questionable value (F, Q) will be treated as lower quality data than values with 'good' or 'unspecified' codes when being compared within the time series, but may still pass the level 1 quality control procedures. Data that is read in with a qualifier code that indicates a 'bad' value (B, R) will not be set good in these programs.

The "quality\_code" column in the *pedrsep* table is set during posting using the *locdatalimits* and *datalimits* tables (see IHFS Quality Code Operations Guide for more information). This code is taken into account before these programs perform their quality control procedures so that values which did not pass this initial screening will not be set good through the level 1 processing routines.

SHEF data qualifier codes for the values output from these programs are as follows:

- R = rejected; did not pass level 1 or was set bad in a previous quality control method
- F = flagged; set bad through entries in the *sensok* table
- S = screened; passed level 1 (exception: not used by transfer\_txn program)
- V = verified; passed level 1 at a higher level than 'S' (only used by transfer\_txn program)

## **2.0 Configuration Information**

These programs make use of the following apps\_defaults tokens:

adb_name	archive database name
adb_dir	archive base directory
adb_pro_que	base directory for 'processed' poster
proclv1	optionally defined token for the SHEF parameter 'type' code of level 1 processed data; default is '1'

These programs are set to run on the cron every ten minutes. They determine which stations to process each time by using the "new\_report" flag in the *ingestfilter* table, which is set to 'Y' when a new value is posted and then set to 'N' after the level 1 processing program has run.

Log files are created in  $\$(adb\_dir)/logs/process$  and overwritten each run.

Shef data files are created in  $\$(adb\_dir)/data/process$  before being copied to the processed posting queue (with a time stamp) and are overwritten each run.

### 3.0 User How-To

These programs may be run manually either through the *arcmenu* --> *Data Processing menu*, or on the command line by simply typing the program name. It is a good idea to run a different version of the program than that which is on the cron, otherwise there is a chance that the output files could clash. There are four different 'versions' of the programs, determined through user input, that generate different output file names.

All programs allow for optional command line arguments that control the 'test' and 'debug' modes (these must be entered before any other arguments if either or both is used):

- t = test mode; do not write to database
- d = debug mode; write everything to the log file

All programs also allow for user inputs to be entered either on the command line or when prompted within the program. The cron programs use the 'default' command line option, which uses default values as described below. Following is a short description of the inputs for each program.

#### ***process\_precip***

1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named *proc\_precip.log*, *ppd\_proc.shef*, *ppq\_proc.shef*, *pph\_proc.shef*
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
2. based on source from above
  - a. which ingestfilter stations to process

- i. all
    - 1) all active entries with PEDTSEP=PCIR\*ZZ
    - 2) output file names now become \*.all
  - ii. new - **default**
    - 1) only those entries from above with new\_report='Y'
- b. input file name
- 3. type of processing
  - a. all = create 24, 6, and 1 hour increments - **default**
  - b. dly = create 24 hour increments only
  - c. six = create 6 hour increments only
  - d. hrly = create 1 hour increments only
  - e. dlysix = create 24 and 6 hour increments
  - f. sixhrly = create 6 and 1 hour increments
  - g. dlyhrly = create 24 and 1 hour increments
- 4. start date for processing (YYYYMMDD)
  - a. **default is 3 days back**
- 5. end date for processing (YYYYMMDD)
  - a. **default is today**

***transfer\_precip***

- 1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named trans\_precip.log, ppd\_trans.shef, ppq\_trans.shef, pph\_trans.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
- 2. based on source from above
  - a. which ingestfilter stations to process
    - i. all
      - 1) all active entries with PEDTSEP=PPDR\*ZZ, PPQR\*ZZ, or PPHR\*ZZ
      - 2) output file names now become \*.all
    - ii. new - **default**
      - 1) only those entries from above with new\_report='Y'
  - b. input file name
- 3. start date for processing (YYYYMMDD)
  - a. **default is 5 days back**
- 4. end date for processing (YYYYMMDD)
  - a. **default is today**

***process\_stage***

1. *optional*
  - a. -high = use the 'highscreenf' value from the rivercrit table to throw out high flows
  - b. **default** is to use the 'ultimatescreenf' (or 'damscreenf') value
2. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named proc\_stage.log, h\_proc.shef, h\_trans.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
3. based on source from above
  - a. which ingestfilter stations to process
    - i. all
      - 1) all active entries with PEDTSEP=H\*IR\*ZZ or Q\*IR\*ZZ
      - 2) output file names now become \*.all
    - ii. new - **default**
      - 1) only those entries from above with new\_report='Y'
  - b. input file name
4. start date for processing (YYYYMMDD)
  - a. **default is 2 days back**
5. end date for processing (YYYYMMDD)
  - a. **default is today**

***process\_temp***

1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named proc\_temp.log, ta\_proc.shef, txn\_proc.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
2. based on source from above
  - a. which ingestfilter stations to process
    - i. all
      - 1) all active entries with PEDTSEP=TAIR\*ZZ
      - 2) output file names now become \*.all

- ii. **new - default**
    - 1) only those entries from above with new\_report='Y'
  - b. input file name
- 3. start date for processing (YYYYMMDD)
  - a. **default is 1 days back**
- 4. end date for processing (YYYYMMDD)
  - a. **default is today**

***transfer\_txn***

- 1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named trans\_txn.log, txn\_trans.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
- 2. based on source from above
  - a. which ingestfilter stations to process
    - i. all
      - 1) all active entries with PEDTSEP=TAIR\*(X/N)Z
      - 2) output file names now become \*.all
    - ii. **new - default**
      - 1) only those entries from above with new\_report='Y'
  - b. input file name
- 3. start date for processing (YYYYMMDD)
  - a. **default is 1 days back**
- 4. end date for processing (YYYYMMDD)
  - a. **default is today**

***process\_sw***

- 1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named proc\_sw.log, sw\_proc.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
- 2. based on source from above

- a. which ingestfilter stations to process
  - i. all
    - 1) all active entries with PEDTSEP=SWIR\*ZZ
    - 2) output file names now become \*.all
  - ii. new - **default**
    - 1) only those entries from above with new\_report='Y'
- b. input file name
3. start date for processing (YYYYMMDD)
  - a. **default is 1 days back**
4. end date for processing (YYYYMMDD)
  - a. **default is today**

### ***process\_flow***

1. source for list of stations to process
  - a. db
    - i. create list from ingestfilter table - **default**
    - ii. output files named proc\_flow.log, q\_proc.shef
  - b. file
    - i. read list from file (with format LID PEDTSEP)
    - ii. output files named same as in (a) with .file extension
  - c. default
    - i. use default values for all inputs
    - ii. output files named same as in (a) with .def extension (used by cron)
2. based on source from above
  - a. which ingestfilter stations to process
    - i. all
      - 1) all active entries with PEDTSEP=Q\*DR\*ZZ
      - 2) output file names now become \*.all
    - ii. new - **default**
      - 1) only those entries from above with new\_report='Y'
  - b. input file name
3. start date for processing (YYYYMMDD)
  - a. **default is 5 days back**
4. end date for processing (YYYYMMDD)
  - a. **default is today**

## **4.0 Troubleshooting Information**

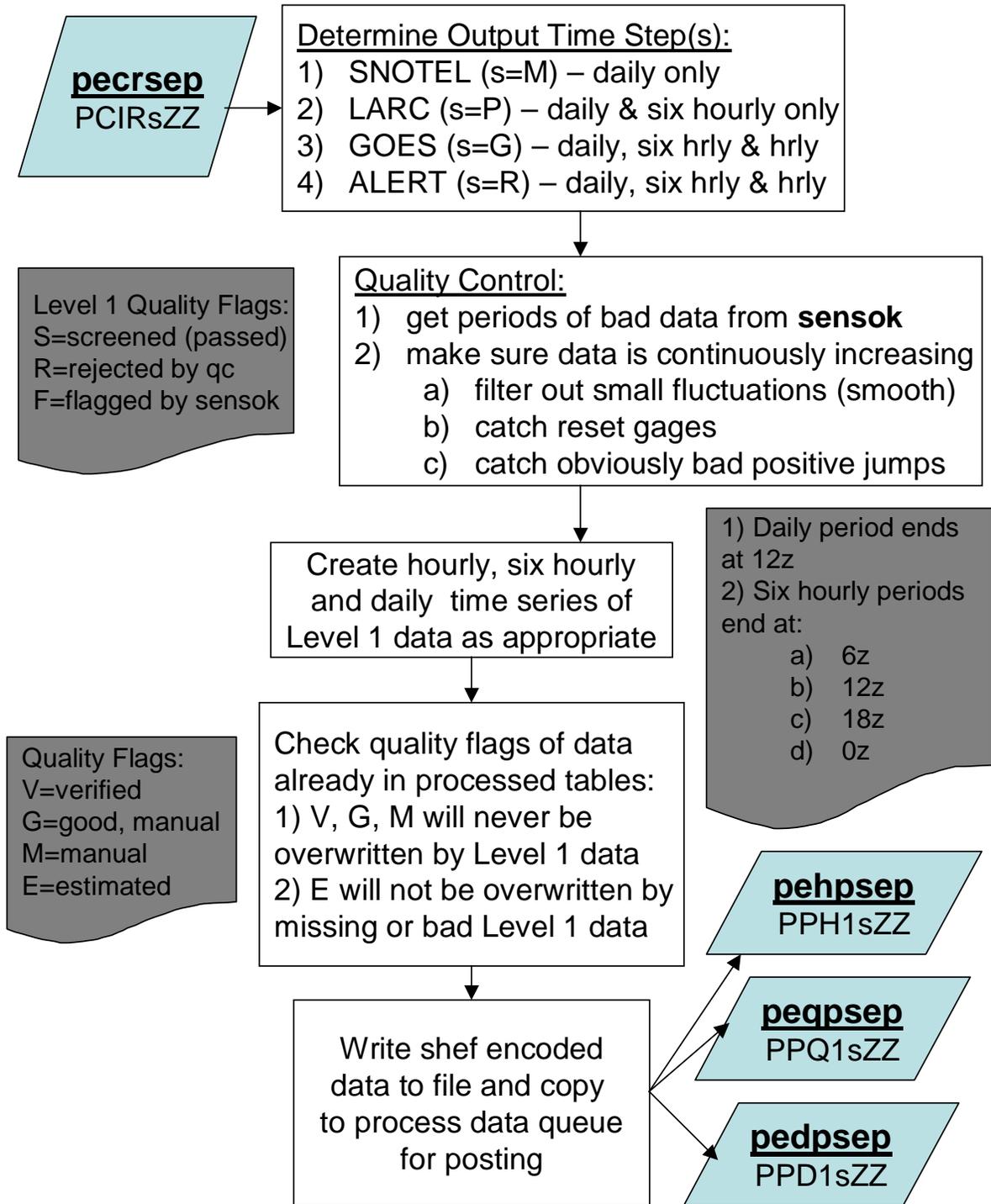
If there are concerns with how a site's data is being processed, run the specific processing program with the debug and test modes turned on and with input from a file and look at the log and data files. If the user still has problems, contact the RFC Support Group.

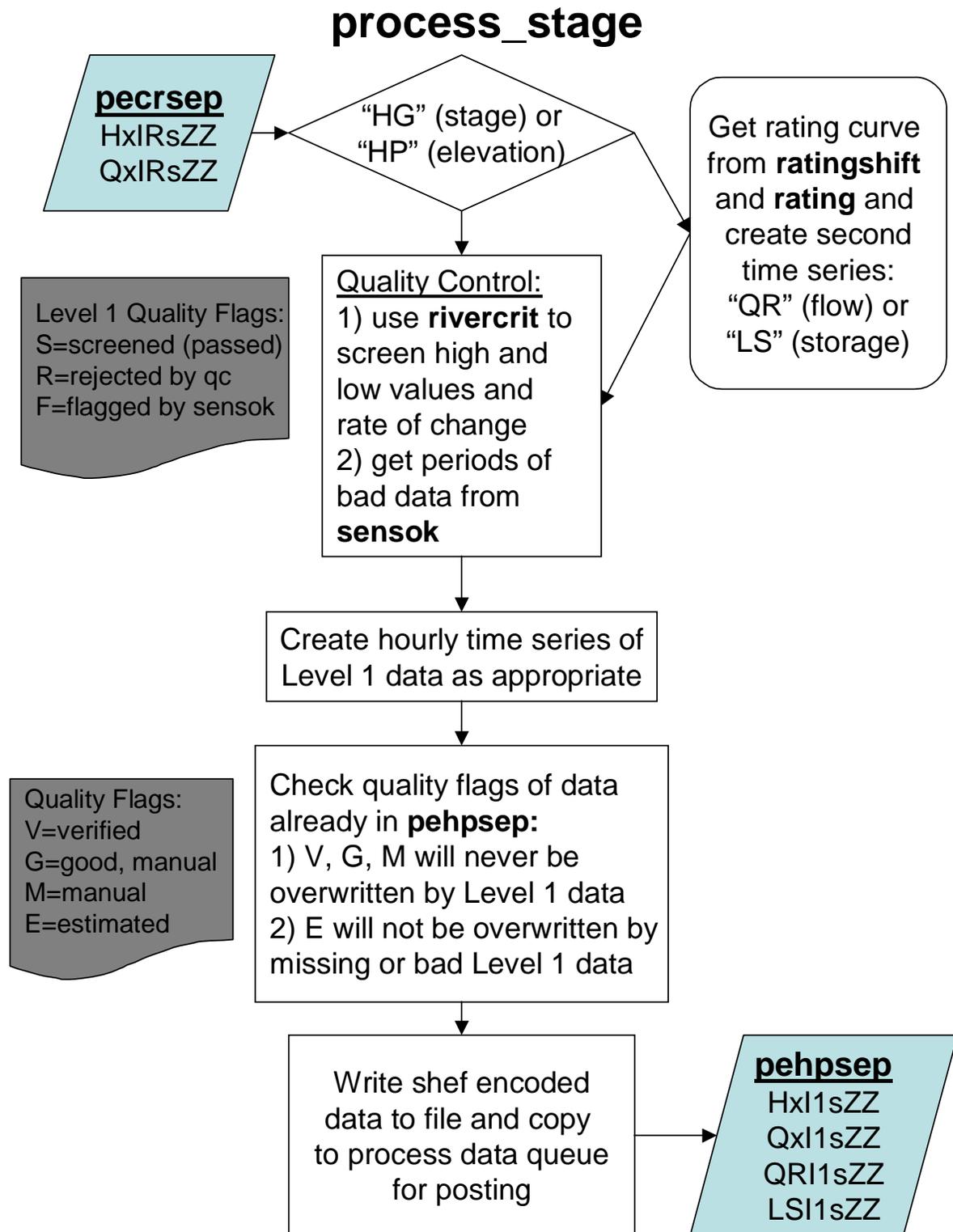
## 5.0 References

Archive Database data dictionary  
SHEF Version 2.0 Handbook  
IHFS Quality Code Operations Guide

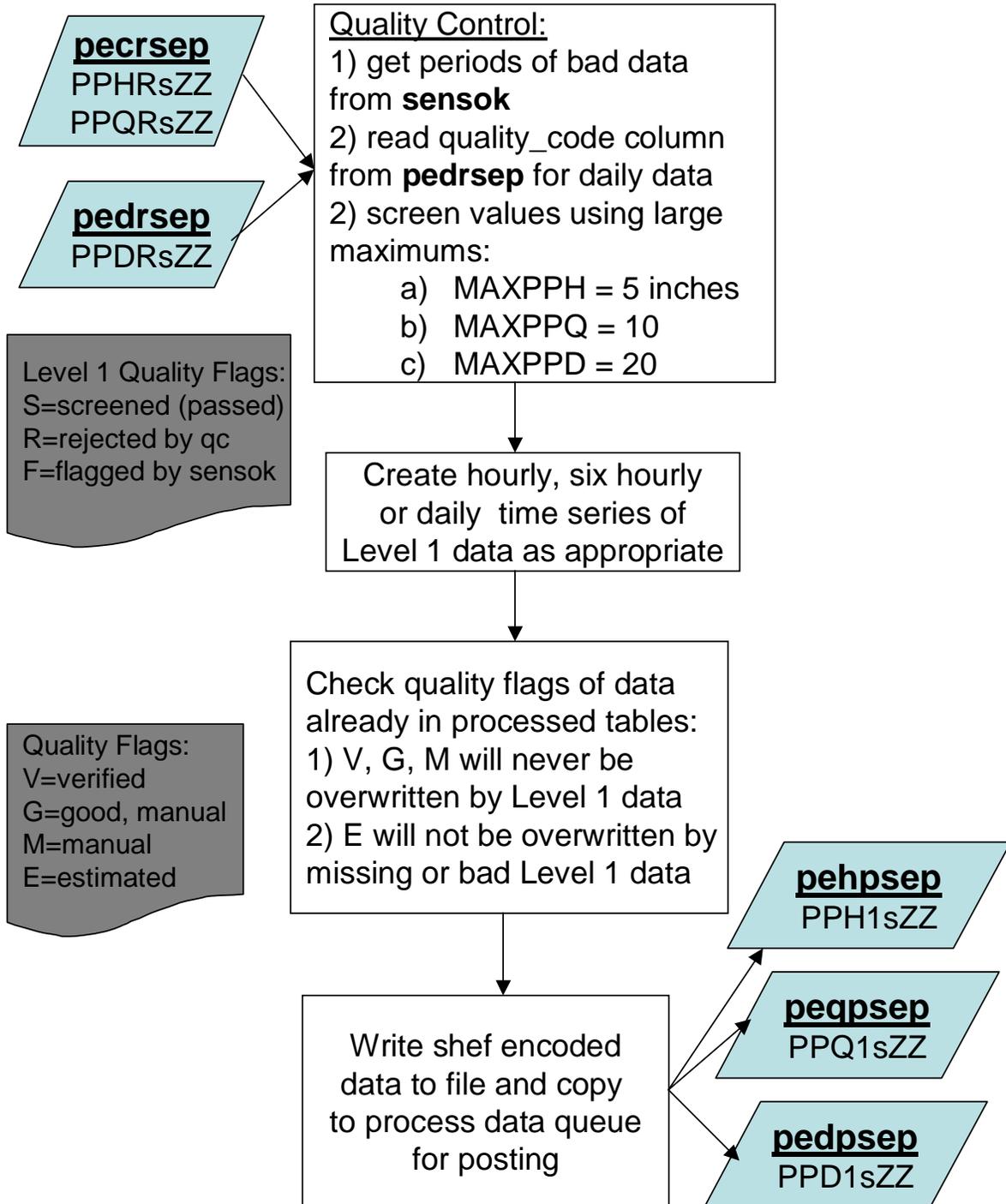
## Attachment A Flow Charts

### process\_precip

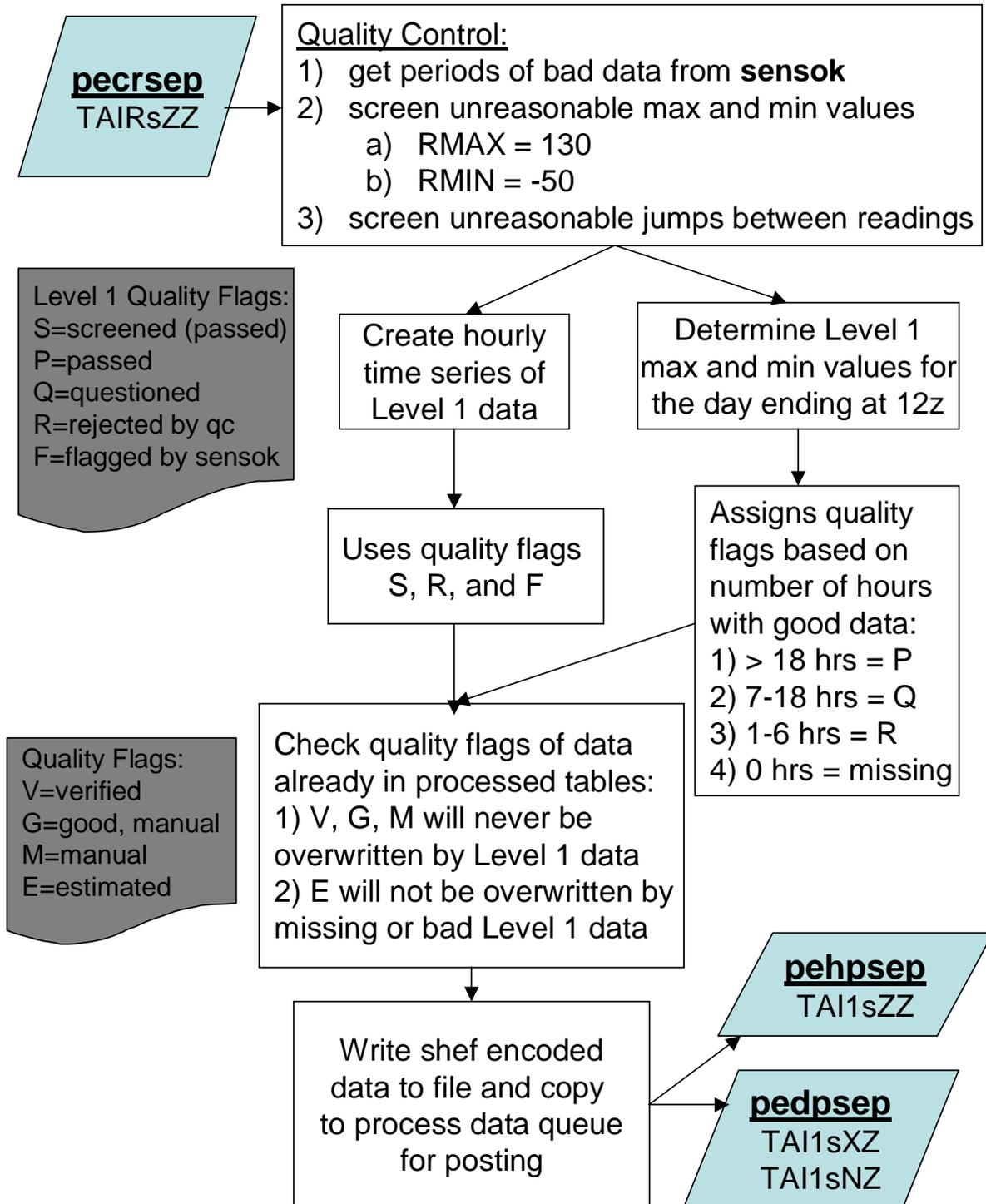




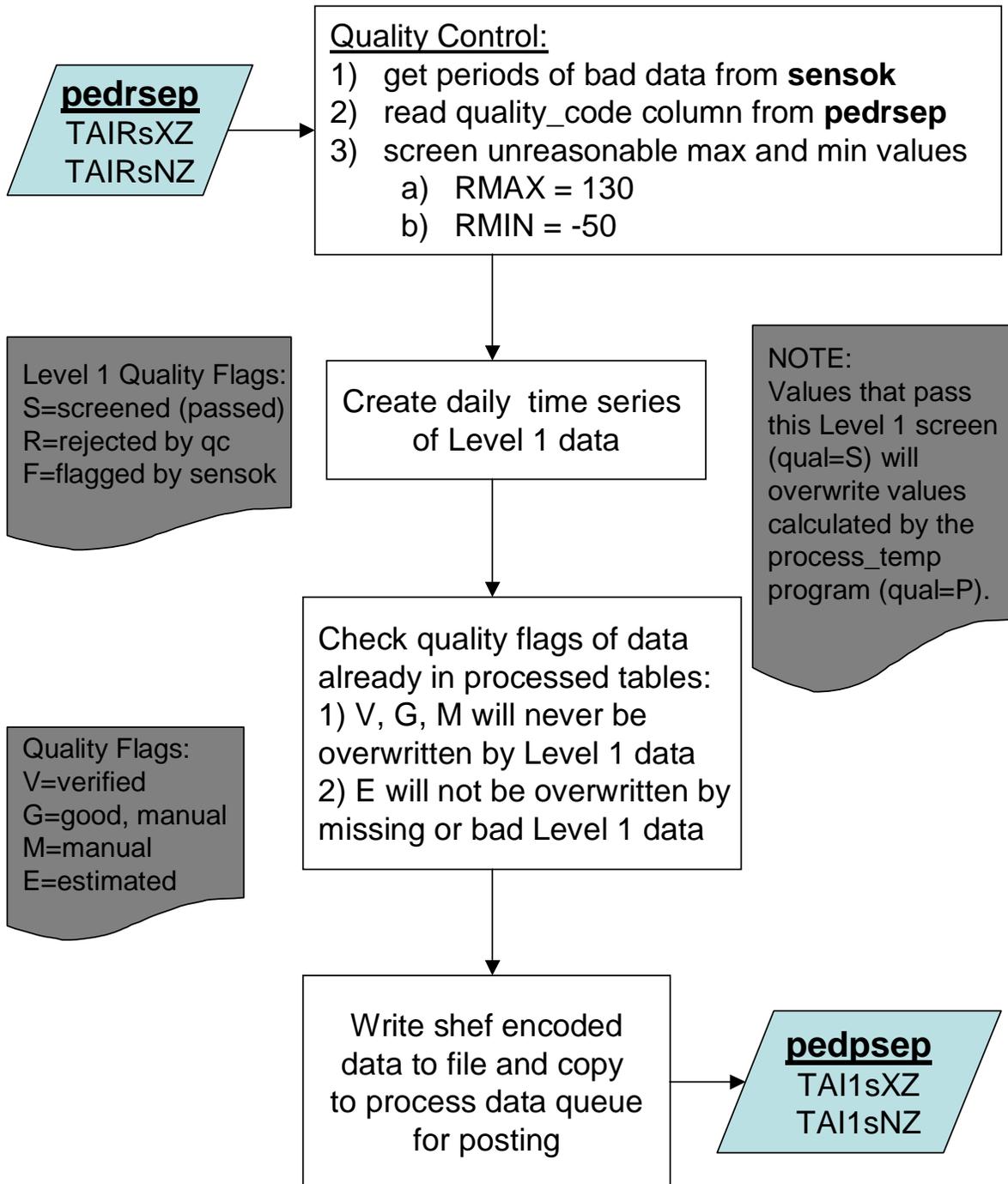
# transfer\_precip



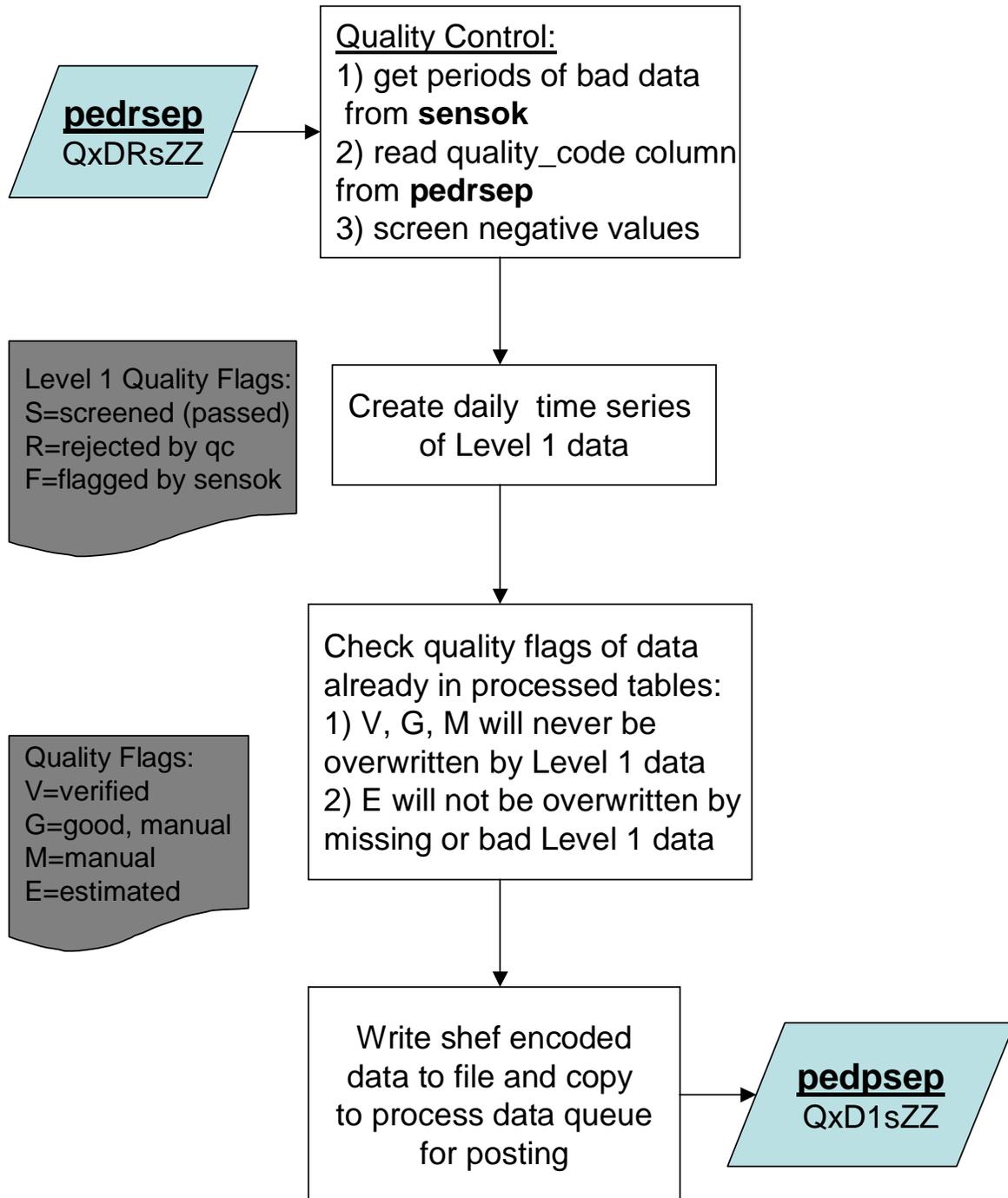
# process\_temp



# transfer\_txn



## process\_flow



## process\_sw

